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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/660,483	09/12/2003	Koji Mishima	2003_1305	6334

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EXAMINER

LEADER, WILLIAM T

ART UNIT PAPER NUMBER

1742

DATE MAILED: 03/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/660,483	<b>Applicant(s)</b> MISHIMA	
	<b>Examiner</b> William T. Leader	<b>Art Unit</b> 1742	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 29 December 2005.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on December 29, 2005, has been entered.

### ***Claim Rejections - 35 USC § 103***

2. Claims 1-6, 11, 12, 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dubin et al (5,972,192) in view of Reid et al (6,716,334) and Landau (6,261,433), and further in view of Erb (6,107,186).

3. The Dubin patent teaches several different embodiments, one of which includes a first plating step, an etching step and a second plating step. Reid discloses a step of pretreatment before plating (column 1, lines 11-15), but does not provide details of the pretreatment step. Landau provides details of a pretreatment step prior to plating in which a wafer is pretreated with ultra pure water to ensure complete wetting, and notes that surfactants improve wetting. Thus, in combination with Reid, Landau suggests a pretreatment with water containing a surfactant prior to plating. The suggestion to pretreat a substrate prior to plating is considered to apply to both the first and second plating steps of Dubin. Thus, by pretreating in this manner before the second plating step of Dubin, the wafer would be brought into contact with a processing liquid

offering surface activity after an etching step as recited by applicant. Alternately, the processing liquid offering surface activity recited in instant claim 1 may be considered to be the plating solution itself. Applicant's specification states that the substrate is brought into contact with the processing solution before the substrate is plated and/or while the substrate is being plated (page 3, lines 12-13). The only way in which the substrate can be in contact with the processing solution while it is being plated is for the plating solution itself to be the processing solution. Instant claim 1 makes no distinction between the composition of the plating and processing solution, thus allowing the plating and processing solutions to be the same. By performing the second plating step in the plating solution after the etching step, Dubin meets the limitations of claim 1 since the wafer necessarily is in contact with the plating solution. It is noted that the plating solution of Dubin contains brighteners and levelers which serve as accelerators and inhibitors, commonly organic and sulfur compounds, as additives (column 6, lines 32-34 and lines 59-62). As noted at page 5, lines 4-5 of the specification, the organic substance or the sulfur compound in the plating solution is effective to increase wettability. Consequently, the processing solution of instant claim 1 reads on the plating solution of Dubin.

4. Claim 1 has been amended to recite that the substrate has a high-density area with closely-spaced grooves and a low-density area free of grooves. The Dubin patent is silent as to the configuration of grooves to be filled. The Erb patent is directed to the metallization of a semiconductor wafer. As shown in figures, the wafer has areas with a high density of grooves and areas free of grooves. This is typical of a semiconductor wafer. It would have been obvious for the wafer of Dubin to have had the configuration of grooves shown by Erb because it

Art Unit: 1742

represents a typical wafer. Choice of the amount of material to remove as recited in claim 15 would have been a matter of routine optimization with respect to the actual distribution of grooves on the surface of the wafer.

5. Claims 7-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Reid et al (6,716,334) in view of Landau (6,261,433) and further in view of Hymes (6,423,2000).

6. The Reid et al patent is directed to a method and apparatus for electroplating a metal onto a semiconductor wafer. The plating metal may be copper (column 2, lines 51-54). Reid et al teach that in conventional plating, the wafer is processed serially through three separate stages: pre-treatment, plating and rinsing (column 1, lines 11-15). Reid et al disclose an apparatus in which multiple operations may be performed. These operations include spraying pure water onto the wafer. Reid et al recognize that it is undesirable for excess water to enter the plating solution because the solution would be diluted (column 1, lines 29-34). The apparatus of Reid et al is designed so that the wafer may be spun while water is sprayed onto the wafer. During the spraying, the wafer may be positioned so that the water spun from the wafer is collected separately and does not dilute the plating bath (column 3, lines 32-60).

7. Instant claim 7 differs from the process of Reid et al by reciting bringing the substrate into contact with a processing liquid offering increased wettability between the plating solution and the substrate surface. As noted above, Reid et al discloses pretreatment prior to plating, but does not describe the pretreatment in detail.

8. The Landau patent is directed to electroplating a metal onto semiconductor wafers.

Landau teaches that prior to plating, ultra pure water can be introduced to the substrate plating surface to ensure complete wetting which enhances the electroplating process (column 18, lines 35-39). Landau also notes that surfactants improve wetting by reducing surface tension (column 18, lines 40-41).

9. Claim 7 additionally differs by reciting separate processing units arranged in the same horizontal plane. The Hymes patent is directed to the deposition of copper interconnects. Figure 2b illustrates electroplating apparatus. Module 204a provides a treatment where oxide is removed from the seed layer prior to treatment in module 204b and electroplating module 204. As shown in figure 2b, the modules are arranged in a horizontal plane.

10. It would have been obvious to have utilized the wetting treatment disclosed by Landau as the pretreatment in the process of Reid et al because complete wetting of the substrate plating surface with the plating solution would have been obtained. By teaching that dilution of the plating solution should be avoided, Reid et al suggest the removal of excess wetting liquid from the substrate surface after pretreatment and prior to plating. As noted above, Reid et al teaches removing liquid from the wafer by spinning the wafer. This meets the limitation of instant claim 8. Additionally it would have been obvious to have provided the treatments in separate units arranged horizontally as shown by Hymes because such an arrangement allows efficient processing of wafers. The apparatus of Reid et al is adapted to performing multiple process steps, meeting the limitation of instant claim 9.

Art Unit: 1742

11. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dubin et al (5,972,192) in view of Reid et al (6,716,334) and Landau (6,261,433) and further in view of Erb (6,107,186) as applied to claims 1-6, 11, 12, 14 and 15 above, and additionally in view of Yamakawa et al (4,906,341).

12. Claim 10 recites that the substrate is repeatedly brought into contact with the processing liquid. The Yamakawa et al patent is directed to a process for electroplating a semiconductor workpiece. Yamakawa et al teach that bubbles may form on the surface of the semiconductor. To ensure more complete contact, the plating solution is preferably applied a plurality of times. See column 3, lines 36-64. The contacting of any of the processing solutions in the process suggested by Dubin et al in view of Reid et al and Landau a plurality of time would have been obvious because more complete contact would have been ensured as taught by Yamakawa et al.

13. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Reid et al (6,716,334) in view of Landau (6,261,433) as applied to claims 7-9 above, and further in view of Yamakawa et al (4,906,341).

14. Yamakawa et al is taken as above. The contacting of any of the processing solutions in the process suggested by Reid et al in view of Landau a plurality of time would have been obvious because more complete contact would have been ensured as taught by Yamakawa et al.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to William T. Leader whose telephone number is 571-272-1245.

The examiner can normally be reached on Mondays-Thursdays and alternate Fridays, 7:30-4:00.

Art Unit: 1742

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King, can be reached on 571-272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



William Leader  
March 16, 2006



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